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EDITORIAL

In any company of men or women there is one topic which will cause the slumbering trout to rise and stir the concourse to vociferous argument and even clamour. It concerns any questions appertaining to education. The term encompasses a wide field in which there are many facets. It is difficult to define what is meant by the term education, for every individual has his own interpretation. Looking at the subject in the broadest sense this wealth of idea and conception is a good thing, for the subject can never rest in the smooth water of complacency. It might seem strange that, in modern times, there should be such a diversity of opinion, because universal and free education has been available to all in this country for nigh on one hundred years. One might expect that, in this long period of time, the pundits and the learned ones who plan and organise the systems of tuition could have devised some form of co-ordinated plan or method which would have satisfied the aspirations of educationalists and the needs of the trades and professions and provided young people with an adequate background to facilitate their progress towards and in a chosen career. This ideal state has not come to pass and the clamour continues.

There are some who think that there is "too much education" and they produce cogent reasons to support their view. There are some who say that there is not enough education, and likewise they produce evidence in support. Probably the great majority of the critics come from the ranks of those who, whilst giving approval to the urge for education, say that the faults lie in the methods employed which savour of the pump and bucket mentality and the storing of odd pieces of information without regard to their digestion and proper assimilation. They argue that little is done to train the recipient of knowledge to use his brain as an instrument of thought and reason rather than as an office file.

At various stages in the victim's progress in the academic sphere he is subjected to tests which are presumed to measure his present capacity and give an indication of what can be expected in the future. These tests attempt to assess

his content in the same way as one can determine the amount of fluid in a bottle by the use of a standard measure. In neither case is the quality or composition considered. The tests fail to measure the potential of either the present or future. At their best they are a measure of memory and very often they indicate only the sum of something which is only temporary and can vaporise in a month. The pupils are able to recite and record certain information at the appropriate time but most of them do not appreciate its significance.

Records are kept of the pupil's prowess in these tests and according to the marks they have gained, the children are classified as good, fair, or poor. This is done at a very early stage in life, and unfortunately the branding is likely to persist and it is extremely difficult for the vicitim to erase such an indelible mark. Little account seems to be taken that maturation may alter the classification. A bright boy of eleven may be mediocre at fourteen and the reverse can occur also. The boy who is marked 'good' has a cross to bear in the same way as one who is held in poor estimation. The former labours under the incubus of his preliminary assessment, with fears of recession hanging like the sword of Damocles over his head. The latter knows that, unless a miracle happens, he cannot erase his brand, and often he will cease to strive and will rest in despair.

Now those who are held in moderate regard, being neither good nor bad, are the most fortunate for as they mature they can advance or fall without exciting tears or comment. Examinations are necessary evils. Many people protest that they should not be taken as a sure guide or indication of capacity. The agitation about the "11-Plus" examination is a token of the public concern. Until some alternative is devised the present system has to stay. Children do manage to survive these hazards of school life and many of them ultimately negotiate the hurdle which will admit them to a University or College.

On paper this hurdle is of a very high standard. Unfortunately schools are often judged by the number or percentage of students who attain this goal. In self defence teachers coach and cram their scholars so that the latter may draw the necessary ticket from the bag. If the pupils are destined for a science career they are stuffed with a miscellany of scientific fact and jargon to the detriment of their cultural development. Then they appear before a selection committee appropriate to their chosen career.

When the numbers of prospective students increased beyond the number of places available selection became possible. Most people thought that the various professions would be able to select the "cream" of the candidates and this would have a profound repercussion which would be reflected in the candidate's ability and progress during his undergraduate days. Hope has not been followed by fact, selection seems to give no better results than the simple rota system. It may be that a profession calls for something more than the ability to acquit oneself with credit in a school type examination. Of this we may have more anon.

PROBLEMS OF VETERINARY ANATOMICAL NOMENCLATURE

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The earliest source of the science of anatomy is represented by animal anatomy. Before man had any knowledge of the structure of the human body, he knew much of the situs viscerum of his game, animal victims and domestic animals, and left behind almost everlasting documentation. During the period of transition from the palaeolithic to the neolithic age Capsian man and especially Magdalenian man incised the outlines of contemporary animals in the walls of rocks and of caverns; often they made coloured pictures. Whereas pictures of man are very diagrammatic, the images of animals are so natural that the species, sex, age, gravidity, motion and the time of year can be recognised. Among the many representations of reindeers existing at this time (e.g. *Cervalces tarandus L.*) the monumental pictures of the thoracic and abdominal organs of Rangifer, which were discovered recently on rocky walls near Askollen in Norway, are highly instructive, even amazing. They show the extensive knowledge which neolithic man and man of the bronze age had in the field of anatomy. In the thoracic cavity, which like the abdominal cavity is represented in left lateral view, the following organs are reproduced correctly as to proportions and topographical relations: trachea, lungs, aorta, oesophagus. The hiatus oesophageus is well outlined in the diaphragm and the following abdominal viscera are clearly visible: recticulum, rumen with dorsal and ventral sac, duodenum, the festoon of the jejunum, the coils of the colon with Ansae centralis, centripetales et centrifugales. The drawings are correct in proportion and so clearly profiled as to leave no doubt. The remarkable knowledge of the situs viscerum allows us to fathom the reasons underlying the making of these pictures. Generally it is assumed that prehistoric representations of animals were made for magic or occult reasons rather than for a primitive art impulse or the accumulation of knowledge. By reproducing pictures of the different beasts of the chase, hunting, and hunting dances, primitive man might have expected to enhance his capacity to kill; or they may have served as lucky charms. Many of the drawings may be imitative. When the surprisingly correct reproductions of the inner organs of the large body cavities of slaughtered animals and victims were made no doubt the artists were filled with hope and any abnormal arrangement might have portended evil results. These practices may point to the existence of a connection between the comparison of the normal situs viscerum and the expected finding on a victim, or religious rites. During the period of gradual development of early civilisation this fear-borne belief of prehistoric man greatly contributed to the extension of anatomical knowledge of viscera, upon which the widest spread system of hieromancy, the splanchnoscopy, was based. Among the ancient peoples, especially among those of the "fertile halfmoon" (Nubia, Egypt, Phoenicia, Judea, Israel,

Syria, Mesopotamia, etc.) the rules which governed the religious rites and feeding customs were based and elaborated empirically on this anatomical knowledge.

At this time little progress was made as regards factual knowledge of the structure of the human body. Interest in the morphology of the body as a whole was lost. Conjecture replaced fact, the body was reproduced for some abstruse reason in a schematised way. There was no need for accurate observation and pictorial reproduction of organs and, in consequence, pictures of this kind were not required. In the earliest times of man's existence the representation of human organs was prevented by fear of death and later this attitude was intentionally cultivated and developed into the taboo complex.

This attitude was maintained up to historic times and even today it may be found in some primitive peoples. In highly civilised countries law, religion and custom did not sanction human dissections or the practice was confined to certain localities. The knowledge in this field of anthropotomy was firmly based on zootomy, i.e. on the findings of Hippocrates (460-377 B.C.) who had some anatomical experience with pigs, dogs and cattle. Other sources were the writings of Democritus and Aristotle (Historia animalium). Knowledge of the structure of the human body was obtained *per analogiam* or even in a purely speculative way. The most important representatives of the Greek medical schools, i.e. those of the Ionic school (Heraclitus of Ephesus, Empedocles of Agrigentum, Diogenes of Apollonia), gained their anatomical knowledge from experience with animals. Herophilus and Erasistratus, who at the Alexandrian school had opportunity of studying both the dead and living human body, were famous exceptions among the classic anatomists. The study of the animal organism gave anatomy its broad foundation. Claudius Galen (A.D. 131-201), who as a scholar of the Alexandrian school had some experience in the field of anthropotomy, fully realised the advantage of comparative investigations. He, not only because of the difficulties met with in procuring human cadavers for dissection, repeatedly and insistently recommended the surgeons to be eager in dissecting animals most resembling man (Simiae, Suidae) in order to prepare themselves for the study of the human body. It is noteworthy that since the time of Vesalius this recommendation has continued to be of topical interest owing to interdictions of different kinds, such as the interdiction of the omission of burial and desecration of tombs (Cassiodorus, 7th century), of robbing human cadavers for dissection (Salic law), of the dissection of human cadavers and maceration of bones (bull of Pope Boniface VIII), etc., as well as because of the difficulties which, even today, the anatomical institutes meet with in procuring human cadavers.

The intimate relation between the anatomy of man and the anatomy of animals, especially of mammals, is also shown by the fact that many important findings of anthropotomy were discovered, described or studied in animals. This may be proved by many examples of which I will cite a small number only: the discovery of the chyle vessels in the mesentery of the dog by Caspar Aselli in Pavia (1622), the demonstration of the thoracic duct in some domestic animals by Jean Pecquet (1647), the discovery of the pancreatic duct in the turkey (1641) by the anatomist Moritz Hofmann in Altorf; one year after Johann Georg

Wirsüng, prosector at Padua, demonstrated the duct in human cadavers. The first reports on the thymus were based on observations made in slaughter animals and other animal victims, especially in calves. The discovery of blood circulation by William Harvey (1616) was a result of thorough investigations on animals, especially on bovine foetuses and calves. In 1660, Nils Stensen was the first to describe the parotid duct in the sheep. The thorough investigation of the spleen of man was initiated by a detailed description which Blasius gave in his book *Anatomia animalium*, published in 1681 in Amsterdam. A few years afterwards (1686) Malpighi described his corpuscles and explained the significance of the trabeculae. Ludwig Levin Jacobson discovered the vomero-nasal organ in several wild and domestic mammals ; 30 years after the discovery, Hyrtl stated that no traces of this enigmatical organ had been found in man. In 1912, the veterinary anatomist Eberhard Ackerknecht described a peculiar rudimentary organ found in the floor of the mouth cavity of domestic mammals ; it was not until 1925 that this finding could be confirmed in man by Walther Eberle, a scholar of Ackerknecht. Let us only shortly refer to the inseparable connections of comparative anatomy and anthropotomy and to the great benefits which anatomy of man has drawn from comparative investigations since the time of d'Auberton, Vicq d'Azyr, Camber, Owen and of the brothers Hunter. Since the time of Haller and Wolff there has been an intimate relation with regard to embryology. The great anatomists of the past were fully aware of the connection and interdependence of animal and human anatomy and always insisted upon the unity of this science. Among others, Hyrtl in his textbook of anatomy defined anatomy as the science of the organisation of both kingdoms of nature and the anatomy of man as a small part of zootomy. Already at this time one could observe separatistic tendencies and specialisation in the field of anatomy and this might have been the reason why Hyrtl said that teachers who are willing or able to appreciate fully the significance of animal morphology (p.49) are becoming rare. It may be seen from the history of anatomical nomenclature, that strong efforts have been made to preserve the unity of the science of anatomy. However, the men who have been making these efforts are still diminishing in number and strength although the separatists have not been able to produce any sweeping argument for their case. Should it need scientific argument when a reputable anatomist of our time says that veterinary anatomists may use the term V. cava caudalis (instead of V. cava inferior). Because the separatists, who replaced the generally approved anatomical terms which had been applicable to all vertebrates, including man, by terms applicable only to the individuals of a single species that have learned to keep their body in upright position, might not have felt quite at home among others, the committee consented to use in exceptional cases the reference terms 'ventralis, dorsalis, cranialis, caudalis.'

The unity of anatomy was sacrificed on the altar of science on behalf of clinicians and practising physicians. The most drastic change was made by introducing the upright position as the standard position. The hope that an anatomic nomenclature for general and international use might be evolved, has been frustrated. Nomina anatomica corporis humani was born, not nomina anatomica.

Now the representatives of veterinary anatomy, comparative anatomy, zoology,

palaeontology, embryology, histology, biology and genetics must join to overcome the nomenclatural difficulties resulting from the N.A.P.[1]

N.A.V.[2] could be built up systematically in two different ways.

The first method would be to examine and determine the technical terms of animal anatomy *ab ovo* independently and uninfluenced by the results of all nomenclature conferences so far available. This means that a great number of new technical terms would have to be invented or linguistically constructed and fundamental changes would be required. This would be a long and difficult job leading to radical differences of opinion and would further widen the gap between the nomina anatomica corporis humani and the nomina anatomica corporum animalium. From several sides a suggestion has been made that independently of the tradition and historical development of anatomical terms a revolutionary nomenclature should be introduced (a sort of anatomical Esperanto) which ought to be constructed, so to speak, on the basis of an anatomical decimal classification system. This could apply especially in myology, where historical development has led to several systems of denomination being used side by side or together, e.g.:

topographically, i.e. according to origin and formulation ;

morphologically, i.e. according to the form of the belly of a muscle ;

functionally, i.e. according to the effect on joints.

These efforts are not new. From the time of Cl. Galenus (A.D. 131-210) to Franciscus Sylvius (1614-1672) muscles have been denominated exclusively by the use of ordinal numbers in relation to their region and depth. Only Sylvius and Jean Riolan (1580-1657) worked out a methodical although not uniform nomenclature. They quoted in their publication the direction, position, shape, size, structure, function, etc., as an aid to correct terminology. The most outstanding classical work of veterinary anatomy, published in 1598, *Anatomia del cavallo* by Carlo Ruini (1530-1598) also numbers the muscles (e.g. the first . . . the 29th, and the last muscle of the neck). Claude Bourgelat (1712-1779) accepted for his *Elemens de l'Art Vétérinaire* (1759) for the most part the appropriate expressions of anthropotomy and only in the section " sacrology " are the terms " le premier . . . le sixième des muscles des oreilles " to be found in relation to the muscles of the ear. Jean Girard (1770-1852) completed the work of Bourgelat by using Chaussier's anthropotomical and modernised manner of expression for veterinary medicine in his *Traité d'Anatomie Vétérinaire*.

The language of anatomy has evolved gradually and it has shown favourable mutations during its development. To destroy this language which has been in existence for more than a thousand years and to replace it by a nomenclatorical homunculus gives no promise of success, even if the ingredients are chosen as ingeniously as possible.

For the first international nomenclature there remains only the second system, which retains the old stock of traditional anthropotomical and zootomical terms

[1] Nomina anatomica Parisiensia (1955). [2] Nomina anatomica veterinaria.

and uses the existing nomenclature—even following the N.A.P. as far as possible —and forms its own technical terms or modernises the old ones only where this is essential, if there are no existing terms at all or if the terms in existence cannot be applied to human anatomy. As far as is compatible with the principles of comparative anatomy, homology and anatomy, the I.C.V.A.N.* will have to meet the N.A.P. half-way, and its work must remain in continuous contact while anthropotomical expressions must be kept under constant review.

Let us consider the technical part of our work. There are a number of ways of describing the standard position of the body. The upright position of the human body cannot be a true reference position for anatomy in its widest sense. The spinal column of a human is not vertical always. A man has to spend a great deal of his life in other positions. When *in utero*, during sleep, resting, and during illness he occupies such a position that the terms "anterior" and "posterior" cannot be applied without some ambiguity. Incidentally in the case of the os sacrum the N,A,P. speak of a "facies dorsalis" and of "foramina sacralia dorsalia" and try to explain this by saying that it may be desirable because of the more horizontal situation of the sacrum in the upright position of the body.

We must take the standard position of an animal body to be that occupied when it rests on all four extremities and the spinal column is "horizontal" and the most important technical terms *situm et directionem indicantes* to be "dorsalis-ventralis" and "cranialis-caudalis."

The superiority of the expressions dorsal-ventral, cranial-caudal has been accepted with regard to man by such authorities as Albert von Kölliker and Hermann Stieve. The latter pointed out that in many cases anatomy is not studied on the upright body, but on the corpse lying on its back, or on sick people lying in bed, and that during development the embryonic disc lies in a "prone" position. "In this stage of human development the conformity of designation of position with that of the other vertebrates is therefore not an artificial invention of ours but reflects an existing fact. As countless, if not all relations of the fully developed human body in all its systems are comprehensible only in relation to the structure of the embryo, nothing can be said against replacing the indications of direction by terms generally applicable to vertebrata and metazoa. Anyone who refuses to accept this makes an arbitrary division between human phylogeny and human anatomy." So wrote Stieve in the preface to the Jenaer Nomina Anatomica drawn up by the Nomenclature Commission of 1923 in consultation with the Anatomical Society of Great Britain and Ireland and the American Association of Anatomists. I suggest that such a refusal would cause a split not only in anthropotomy but also in the whole of anatomy and would add to the difficulties of the subject. Nevertheless we should remain in close contact with the N.A.P. and accept their suggestions whenever this can be done without danger of ambiguity. Assuming a maximum uniformity of nomenclature, it would be possible to speak of a ganglion cervicale superius and inferius in a tetrapodic mammal instead of a cranial and caudal ganglion, for with all animals in the

* *International Commission for Veterinary-Anatomical Nomenclature.*

standard position mentioned there is actually a difference of height in the level of the ganglia. It is not possible to use the expressions Aa.phrenicae superiores and inferiores as these arteries do not lie one above the other but one behind the other. To quote other examples we cannot speak of a facies anterior and posterior and of an extremitas superior and inferior renis or of a margo anterior and posterior testis as in different species the longitudinal axis of the testicle is not arranged in a constant manner in relation to the body. There is no objection to the walls of the stomach being called paries anterior and posterior or the surfaces of the iris facies anterior and posterior. The N.A.P. have rejected also a number of technical terms e.g. orificium uteri internum and externum. We cannot do without these appelations as the terms isthmus uteri and ostium uteri are applicable to the uterus simplex only when in the non-gravid state. They are not applicable to the uterus duplex, uterus bicornis or uterus bipartitus.

Another important aid in the anatomy of the quadrupeds is the introduction of a new classification of the planes of the animal body. The principal planes of the animal body are:

(1) The planum medianum (the middle plane);

(2) The planum sagittalia (the sagittal planes parallel to the middle plane);

(3) The plana segmentalia (the segment planes, crossing or transverse planes); and

(4) The plana dorsalia (back planes). This lies at right angles to the plana sagitallia and segmentalia, passing through the columna vertebralis and corresponds to the plana frontalia of the human body. Usually the frontal planes of the animal when standing still are at an oblique angle to the sagittal planes and segmental planes and therefore they cannot be used as third vertical co-ordinate planes or projection planes. In tetrapods these dorsal planes are called in error horizontal planes. Their position is only horizontal in space if the animal is standing still. When the animal is lying down, especially if it be on its side, their position is oblique. This ambiguous expression "horizontal plane" proves that all anatomical reference expressions have to be related to the body itself and that a relation to external things or to the human being who is observing should not be implied. This means that expressions such as: front, rear, top and bottom, horizontal and vertical should not be used.

These are only a few indications of the importance of our work as far as it concerns the comments of the N.A.P. We must consider also those *terms used in veterinary anatomy, which do not exist at all in anthropotomy* and which cannot figure in the nomina anthropotomica (Parisiensia). For the purposes of our work this group of anatomical expressions falls into two subsections. Firstly—those terms which exist already and secondly—those for which a final and binding Latin expression does not exist.

As far as the linguistic part of our work is concerned we do not want to be pedantic philologists and we should not overrate orthography and etymology. If

a technical term has been current for a long time and its meaning is clear but is etymologically slightly incorrect we will not suppress or alter it. With regard to orthography the N.A.P. are by no means always consistent. They often replace the *æ* (the Greek αι) by an *e* as in hemisphe*r*ium, ary*t*enoidea (from ἀρύταινα = ladle with a pouring lip) or in *e*quator (Latin from *aequus*—and not *equus*—horse) etc. On the other hand, while the original edition of the N.A.P. (Spottiswoode, Ballantyne & Co., London and Colchester, 1955) has "anconeus"—K. H. Knese's nomina anatomica (5th edition of nomina anatomica by Kopsch; published by Georg Thieme, Stuttgart, 1957) has "anconaeus" because the word originates from the Greek ὁ ἀγκών=curvature, anchor. A uniformity must be preserved if the Greek and the Latin ae are spelled as *æ*. The standard of scientific Latin should be Classical and Middle Latin and not Dog Latin. Although it is customary to do so in some English and French-speaking countries, one cannot accept the alteration of the diphthong "æ" (pronounced "e" as in "egg") into a plain "e."

I think this is the right place to set forth a few of the principles that should be observed in veterinary anatomical literature, which were published in the *Wiener Tierärztliche Monatsschrift* (1958, No. 6). Where necessary we will give additional explanations, discuss these principles and finally use them as basic rules. A number of these principles (Nos. 1—6) are already being used as a basis by the Anatomical Nomenclature Committee for the N.A.P.

(1) Every anatomical concept is to be denominated by one single expression only, apart from a very limited number of exceptions; e.g.

Tunica serosa (uteri)=perimetrium, tunica muscularis (uteri)=myometrium, tunica mucosa (uteri)=endometrium, tunica fibrosa (ligamenti lati uteri)=parametrium.

(2) When using the Latin language or hybrid expressions, the Classical and Middle Latin form should be used. Alterations into Dog Latin and modifications due to orthography as well as the inclusion of elements from modern languages, especially prefixes and suffixes, should be avoided.

(3) Every technical term should, as far as possible, be short and simple. This principle refers above all to veterinary anatomical nomina nova and nomina emendata. The N.A.P. have not always adhered to this principle. They have replaced the plain and simple expressions brachium conjunctivum, brachium pontis and corpus restiforme by the cumbersome expressions pedunculus cerebellaris superior, pedunculus cerebellaris medius and pedunculus cerebellaris inferior. The N.A.P. are of the opinion that these expressions are more informative. I consider that the old names are much more expressive.

(4) The expressions should be short and of descriptive and instructive value. As in the case of the previous mentioned principle this is particularly applicable to the alteration of words and the forming of new words (stimulus conductor system!).

(5) Organs that are in close topographical relation, should be similarly named (e.g. Os femoris, A. femoralis, V. femoralis, N. femoralis).

(6) Distinguishing adjectives should in general be used in pairs of opposites (e.g. dorsalis-ventralis, major-minor, superficialis-profundus, etc.).

(7) The use of proper names in the *international nomenclature* of macroscopic anatomy should be avoided. There are no objections against the use of proper names in the *national* anatomical language (e.g. *International:* organum vomeronasale, *German:* Jacobsonisches Organ; *International:* truncus fasciculi atrioventricularis, *German:* Hissches Bündel; *International:* Bursa subtendinea musculi tibialis anterioris, *German:* Bursa Dickerhoffi, etc.).

(8) The first working period of the I.C.V.A.N.[1] should be devoted to setting up the nomenclature of the macroscopic anatomy of domestic mammals and (separately) of birds. An expansion of the nomina anatomica to include other vertebrates cannot yet be carried out with success for formal and objective reasons. In keeping with progress in the fields of comparative zoology and anatomy this must be done at a later date.

(9) The following should serve as a basis for the work of the commission:

(a) The existing nomenclature catalogues e.g. (*N.A.P., B.N.A.*[2], *J.N.A.*[3]) and the *List being worked on by the Committee on Nomenclature of the American Association of Veterinary Anatomists;* "Terminologia anatomica" by Ed. Sørensen and L. Høeg, (Nyt Nordisk Forlag, Copenhagen 1958); *Die anatomischen Namen, ihre Ableitung und Aussprache"* by Hermann Triepel (25th edition revised by Robert Herrlinger, published by J. F. Bergmann, Munich, 1957); "Der anatomische Wortschatz" by Gerhard Krüger (4th edition, published by S. Hirzel, Leipzig, 1955); *Nomina anatomica Parisiensia (1955) et B.N.A. (1895)* by M. W. Woerdemann (published by A. Oosthoeck Publishing Company, Utrecht, 1957).

(b) The nomenclature of the standard modern veterinary anatomical works in all languages e.g. *Ellenberger-Baum, Nickel-Schummer-Seiferle* (German); *Sisson-Grossman, Hughes-Dransfield, Rooney* (English-American); *Bourdelle-Bressou-Tagand-Barone* (French); *Bruni-Zimmerl* (Italian); *Galleja, G. Gonzalez-A. Gonzales, Serrat* (Spanish); *Ghetie* (Roumanian); *Simic, Koldá, Klimov-Akajevski* (Slavic), etc. This list is not claimed to be a complete one.

The skeleton of the whole structure will primarily be the N.A.P. in its original form (Spottiswoode, Ballantyne & Co. Ltd., London and Colchester) and the comparative list of the nomenclature of Basle, Jena and Paris in the nomina anatomica by Fr. Kopsch (5th edition, revised by K. H. Knese, published by Georg Thieme, Stuttgart).

The book by Prof. Clemens Fritz Werner *Wortelemente lateinisch-griechischer Fachausdrücke in der Biologie, Zoologie und vergleichenden Anatomie* (published by Geest and Portig, Leipzig, 1956) will be of special value to all those working on the project.

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[1] International Commission for Veterinary Anatomical Nomenclature.
[2] Basileae Nomina Anatomica.
[3] Jenae Nomina Anatomica.

(10) The commission will have to comment on the nomina anthropotomica and on the nomina corpororum animalium as laid down below, making use of the literature mentioned under point 9.

(a) *Which technical terms of the N.A.P. can be accepted without reservation for animal anatomy in general and for veterinary anatomy in particular?* Undoubtedly most of the 5640 anthropotomical expressions listed in the N.A.P. will be accepted without hesitation by our commission. There should be no difficulty in accepting into the nomina anatomica most of the 1,100 expressions which have been changed by the N.A.P. and more than 200 of the new terms which have been devised. The remainder and especially those terms that refer to the standard upright position of the human body are not applicable for anatomical nomenclature in the wider sense. These purely anthropotomical expressions should be turned into real nomina anatomica. When accepting or taking over expressions of the N.A.P. we should not be too pedantic, neither in the technical nor in the formal sense.

We can agree to say phalanx proximalis, media and distalis instead of phalanx prima, secunda and tertia; A.genu superior and inferior (lateralis and medialis) instead of A.genus proximalis and distalis (fibularis and tibialis), but we cannot accept A.glutaea inferior and superior and must insist on caudalis and cranialis.

The acceptable anthropotomical expressions will have to be eliminated from the N.A.P. for only the remainder is our working material. Out of this a small part can be separated, viz.

(b) *Those technical terms that can be accepted only with reservations.* Here alterations are concerned that are technically unsatisfactory. If "pedunculus cerebellaris superior" is used insead of "brachium conjunctivum," "pedunculus cerebellaris medius" instead of "brachium pontis" and "pedunculus cerebellaris inferior" instead of "corpus restiforme" and this is justified by the statement that these expressions are more informative, then this seems to be a complete travesty of the truth. The old terms were vivid and full of associations; how poor and colourless are the words superior, medius and inferior. It is a matter of doubt whether the old "inscriptiones tendineae" are, as the anthropotomical nomenclature committee thinks, more exactly described by the expression "intersectiones tendineae." Here too, a specific and expressive term has been replaced by a colourless one. If the "more exact description" is meant to refer to the genesis of the M.rectus abdominis then we can say that the new term is not qualified to explain the development of this muscle. Besides this intersectio does not mean intermediary portion, intermediary part or intermediary tendon for sectio, as a substantive, has the meaning of cut or dissection.

In their study of the N.A.P. reviewers will discover other terms that cannot be used at this time but should be noted for use in a later revision.

(c) *Which terms of the N.A.P.*, which are also of importance for animal anatomy, *cannot be accepted* for technical or important linguistic reasons?

First there are those expressions, which differ according to the standard

positi- i.e. the anthropotomical or anatomical position in the narrow sense and the zootomical or anatomical position in the wider and actual sense. Our suggestions for alterations in this group will mainly relate to angiology, myology and neurology and many "anterior-posterior" constructions will have to be replaced by "ventral-dorsal," similarly "superior-inferior" concepts being replaced by "cranial-caudal." Certain formations that exist only in the human body in special forms and for this reason they are specially named, must be renamed by the generally valid term. Ala major and minor ossis sphenoidalis should be called ala temporalis and orbitalis, for, in many species of animal, the arrangements as to size of the wings is reversed: the small wings are part of the temporal region while the large wings form a great part of the orbita. Even if the suggested nomenclature has a slight flaw—the temporal wings of the human os sphenoidale too have a small facies orbitalis—it is still better and more expressive than the use of the colourless words "major" and "minor." Technically we must object to the replacement of extremitas thoracica and pelvina by the membra (membrum superius and membrum inferius). The expression extremitas should, according to N.A.P., only be used for the ends of an organ. But is there really a danger that e.g. the pelvic extremity will be confused with the caudal renal pole ? If one is too susceptible and too careful in the anatomical direction then one cannot justify the disappearance of the difference between ligamenta (tight connective tissue) and plicae (double folds of serosa) made by the I.N.A. The reintroduction of the expression peronaeus (περοναῖος not, as in the the N.A.P., peroneus as the Greek ending becomes aeus in Latin) in the place of fibularis means a retrograde step from the scientific and systematical aspect and runs counter to the principle of the N.A.P. commission that says that organs that are topographically in close relation should, as far as possible, be similarly named (tibia, mm.tibiales, aa.tibiales, nn.tibiales, and correspondingly fibula, mm.fibulares, aa.fibulares, nn.fibulares). If they had been consistent the N.A.P. should have replaced fibula by perone (ἡ περόνη) an expression which existed hundred years ago. These few examples may suffice to show the great number of corrections necessary; not a few remarks concerning formal improvements.

With words of Greek origin from which an adjective (or a substantive used as an adjective) has been formed by adding the suffix αιος to the stem of the word the Latin suffix should correctly read only—aeus, e.g. ὁ γλουτὸς — γλουτιαῖος (glutiáios)—glutaeus, or ἀγκωνιαῖος (ankoniaios)—anconaeus, belonging to elbow, or τὸ περιτόναιον, peritónaion)— ὁ περιτόναιος χιτὼν (peritónaios chitón)—peritonaeum. If the substantive is of Latin origin as *popl*es, *pecten*, then it must be popliteus, pectineus. It is also wrong to use dentes premolares instead of dentes pr*ae*molares, precuneus instead of pr*ae*cuneus, prepatellaris instead of pr*ae*patellaris, etc. In this case one must stick to the fundamental rules despite the danger of being called a pedantic schoolmaster.

(d) *Which technical terms of anthropotomy cannot be accepted in anatomy in the wider sense,* as their meaning refers only to human beings ? These are names that concern especially the central nervous system and here first of all the tractus and nuclei. But also terms such as mons pubis, tuberculum conoideum, linea trapezoidea, margo lateralis (scapulae), os coccygis, cornu coccygeum, etc.

This small group can perhaps be isolated from the N.A.P. before the work begins.

(e) *Which terms are not included in the N.A.P. although needed for mammalia* especially domestic mammalia ? A few examples out of the great number: os cordis, os glandis, ossa tarsalia, os malleolare, foramen supratrochleare, foramen supracondylicum, margo interalveolaris, m.praeputialis, mm.sacrococcygei, m.retractor bulbi, palpebra tertia, membrana nictitans, especially many names of the apparatus digestorius of mammals, primarily of equidae and ruminantia with their complex conditions in the intestinum crassum or the proventriculi. These terms and those of the following group will have to be listed with abbreviations of the name of the species, as several names can be applied only to certain species. To this group belong also the numerous symbols which we shall have to use for the toe end—organs of perisso—and artiodaktyla.

(f) *Which organs, parts of organs and regions* of the animal body and even of the human body *have as yet no name or no satisfactory name?* Thus for instance a technical term for the "stimuli conductor system" in human and animal does not exist, although parts of this system have already names ; (systema *sinoauriculare* s.sinoatriale and systema atrioventriculare) a comprehensive and explanatory expression for this special cardiac musculature does not exist. Perhaps the whole system can be called "systema excitationis cordis" or "systema inductionis cordis" or "systema stimulationis cordis." At any rate a uniform and internationally applicable naming of the stimulus conductor system is required in physiology, pathology and practical medicine. To this group of nomina anatomica belong those veterinary anatomical expressions for which technical terms either do not exist or only in an unsatisfactory form. E.g. *dental pad* (the strengthened part of stratum corneum of gingiva in the region of corpus ossis incisivi), the "*dorsal turbinate fold*" that is the nasal end of the concha nasalis dorsalis, the "*alar fold*" and the "*ventral branch of the ventral turbinate fold*" these are the nasal ends of the concha nasalis ventralis, the "*groove between the anterior superficial pectoral muscle and the brachiocephalicus*" on each side between the m.brachiocephalicus and the pars clavicularis of the m.pectoralis superficialis, the "*groove between the pectoral muscle*" between the partes clavicularis and the partes sternocostales of the mm.pectorales: "*mass of fat in the brisket*" (in the plica colli ventralis longitudinalis). Perhaps the terms "*ergot*" and "*chestnut*" require some international valid Latin alternatives, as their interpretation as phylogenic rudiments of tori metacarpales and metatarsales or carpales and tarsales are not established scientifically ; further a change of pulvinus, pulvini to *torus, tori* or *torulus, toruli* can be recommended so that they may fall in line with the anthropotomical expressions of the N.A.P. for pads e.g. *torus carpalis (tarsalis), torus metacarpalis (metatarsalis)* and *torus terminalis ;* moreover, the terms for *ovulation fossa, ovulation channel, ovulation surface* in the ovary of a mare are missing ; a Latin expression *for anterior dorsal blind sack of the rumen,* in German "Schleudermagen" (hurling-stomach), has not yet been formulated ; the following nomina are missing for *elevated tonsils, follicular tonsils, raised tonsils ;* "*withers*" ; the "*rose,*" which the mucosa of the anus forms as a functional prolapse in defaecation ; "*muscleband of rectum*" ;

"suspensory ligament of anus"; ventral and dorsal *"dilatation of lumen"** *"abdominal wall"* that is the subregion medially situated from the fold of the flank; for the expression *"fold of the flank"* itself; for the *"shield"* of the boar, regarded as a secondary sex characteristic, a proliferation of the connective tissue of the corium on the shoulder; for many anatomical expressions concerning the coat, etc.

(11) To stress the specific veterinary expressions it is suggested that the following abbreviations be used.

Ma (Mammalia)	Eq (Equidae)	Ru (Ruminantia)	ca (canis familiaris)
Ad (Artiodactyla)	ho (homo)	Su (Suidae)	fe (felis ocreata
Pd (Perissodactyla)	eq (equus caballus)	Ca (Carnivora)	domestica)
Pr (Primates)	bo (bos taurus)	Ro (Rodentia)	cu (lepus cuniculi)
Ho (Hominidae)	ov (ovis ovis)	Av (Aves)	cap (capra
Un (Ungulata)	Bo (Bovidae)	su (sus scrofa)	domestica)

From this description of the various problems of the veterinary anatomical nomenclature commission it can be seen that the working field is extensive and a considerable amount of intense research is required in order to elucidate a great number of points mainly concerning comparative anatomy.

In connection with the general principles of the reform of nomenclature I shall now deal with the *practical programme* and would like first to consider the *nomination of reviewers and co-reviewers* and the arranging of *subcommissions.** It is pleasing to note that proof of interest and offers of collaboration have reached us from many countries. The scope and size of our task necessitates the help of many specialists and experts. In the catalogue the ten main working fields and, in a few of them, the revelant sub-divisions are also listed. A number of reviewers and co-reviewers are already registered but far more are needed and our first action will be to supplement this list. We shall tackle this problem in the third item of our agenda and I think it will be most advantageous if my colleagues make up their minds, according to their personal preference or special knowledge, what subject they want to deal with. The list of reviewers contains a considerable number of colleagues from the United States. The U.S.A. have already a long standing organisation of veterinary anatomists (American Association of Veterinary Anatomists) and this organisation has a "Committee on Nomenclature." Prof. Dr. St. Clair in Urbana, Illinois, has nominated nine American co-workers and mentioned the fields in which they will work. Two Russian colleagues are co-operating also. This is a welcome support to our task which is indeed a world-wide undertaking.

The working lists are the basic elements of our work and the channel for the exchange of scientific views and the results of investigations. On the second and

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*) of ampulla recti.

* Names and addresses will be published separately.

third page the individual nomina anatomica are listed by the reviewers and co-reviewers in extenso. If there are different opinions the co-workers are bound to express their reasons briefly in the column "remarks." For the purposes of comparison and as a systematical basis the N.A.P. and the nomina of the A.V.A. (American Veterinary Anatomists) should be considered. The most important factor for a successful completion of the task is time. The necessary co-operation of so many reviewers requires expeditious treatment of the matter. Therefore the beginning and end of the working time are fixed for every individual reviewer. In this part of the discussion we must decide on the stages of work and how long the working lists can be kept by each reviewer. Work which is submitted should be given priority and must not be put off until other work has been done. The main part of our work must be ready for printing within the year 1959/60.

(12) The work of our collaborators should be carried out according to the following plan:—

(a) Allocation of the fields of work.

(b) With the aid of the "working lists" the reviewers and co-reviewers should start work simultaneously and, when they have completed their tasks, the reports should be exchanged. The work should be completed as soon as possible.

(c) Lists of "terms sub judice" should be sent to all members of the commission for their comment. These comments should be sent to the I.C.V.A.N. so that a meeting may be called to discuss unsolved problems and to arrive at final conclusions.

(d) Corrected and amended lists should be sent to the following bodies for their information and comment.

(i) International Association of Veterinary Anatomists.

(ii) Permanent nomenclature committee of the Anatomical Society.

(iii) Permanent committee of the World Veterinary Association.

(iv) Nomenclature commission of the American veterinary anatomists and as well as to the national Anatomical and Veterinary Anatomical Associations.

(v) Veterinary medical specialist societies (Association of Veterinary Surgeons, Veterinary Pathologists, etc.).

(e) On receipt of the replies from the various interested organisations amendments on an international level can be made and a final decision reached at a combined meeting of the I.C.V.A.N. and the International Association of Veterinary Anatomists.

It may be advisable to discuss in this connection the financial part of our task. Although all co-workers are prepared to work on the project without remuneration, in view of the necessity and urgent importance of our work not

reports should be exchanged. This work should be completed as soon as possible. only in veterinary anatomy but also in universal anatomy and to the whole discipline of veterinary medicine, and the scientific world, a considerable amount of money will be required to finance the purely technical side of our work. Costs for printed matter, postage, paper, specialist literature, translations will, in view of the size of our commission, amount to a considerable sum. This sum cannot be raised either by a single institute or by one single country. Care must be taken to avoid what happened to the previous veterinary nomenclature commission which was not able to get the work printed and published, and therefore, the laborious work that had been done was not turned to any useful purpose.

MALIGNANT MELANOMA IN A SHEEP

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A case of malignant melanoma was observed at meat inspection in a three year old Suffolk ewe which was in good condition. An area of muscle behind the shoulder was depressed and oedematous and the overlying skin contained a number of small black foci. Three vertebrae at the base of the neck were melanotic. The only deep-seated organ to be involved was the liver with its related lymph nodes and this was submitted to the laboratory.

Description of the tumour

The liver weighed 3 lb. 2 oz. and contained a large number of irregularly rounded black masses, mainly discrete and measuring from less than 1 mm. to 57 mm. in diameter. Some of the larger masses were raised above the surface of the liver, especially on the visceral aspect, while others were deeply embedded (Fig. 1). At one site a number of contiguous small nodules presented a mulberry-like appearance. The material in the tumour was soft and intensely black. The hepatic lymph nodes were enlarged and pigmented.

Haemotoxylin and eosin stained sections of liver and lymph nodes were prepared and examined. Each tumour mass of the liver (Fig. 2) consists of many spheroidal cells with rather pale cytoplasm containing varying amounts of melanin. The cells vary slightly in size and sometimes the cytoplasm is scanty. The nucleus is round and more strongly basophilic than the nuclei of the liver cells. Chromatin granules are well marked. Mitotic figures, although present, are not numerous. The melanocytes are in small groups and in some places are overshadowed by deposits of free melanin granules and by massive melanophores of varying shape. Within the tumour well-formed blood vessels are absent and the trabeculae of degenerating hepatic cells are disrupted. Although the margin between each tumour and the liver tissue is moderately well defined both melanocytes and melanophores are present in the parenchyma and in the lymphatics of the portal tracts. The liver cells near the tumour are atrophic and degenerating. The degree of pigment varies slightly from tumour to tumour but this was not evident to the naked eye. The impression gained from Fig. 1, that some of the masses are grey rather than black, is a misleading one and is due to the reflection of light from a glistening, freshly cut surface.

The main part of the pigment in the lymph nodes (Fig. 3) is in melanophores but here also metastases of malignant material are present in sinus and cortex.

Discussion

The occurrence of malignant melanoma in a sheep does not appear to have been recorded previously in the British Isles although Cotchin (1956), in his review, refers to a German report of generalised cutaneous malignant melanoma

in a six year old black sheep (Lund, 1923) and to a report (Steiner and Bengston, 1951) of malignant melanoma of sheep in U.S.A.

It is generally considered that the horse and dog exhibit melanotic tumour formation more frequently that the other domesticated animals although melanoma also occurs in cattle. The colour of the skin may be related to the incidence of the condition within a given species. Grey horses are more often affected than horses of other colours and so far as dogs are concerned Cotchin (1956) has indicated that Scottish terriers are unduly prone to melanomas. Head (1953) observed subcutaneous melanomata more frequently in dark-skinned than in other cattle. In this connection it is interesting that Lund's case was in a black sheep and the present case was in a Suffolk, a breed which normally has black hair on the face, ears and legs. The original lesion was probably in the skin of the post-scapular region, where there was some distortion of the tissues, and from there metastasis was by the lymphatic circulation to the sites mentioned.

Summary

A case of malignant melanoma in a three year old Suffolk ewe is described. Many metastases were present in the liver.

Acknowledgements

I wish to thank Mr. F. W. Murray, M.S.I.A., Deputy County Sanitary Officer, Co. Tyrone, for providing the specimen and for the description of his meat-inspection findings. Thanks are also extended to Mr. D. Mehaffey, A.R.P.S., and Mr. T. Todd, F.I.M.L.T., who prepared the illustrations and to Mr. S. P. Rodgers for technical assistance.

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FIG. 1 Slices of the affected liver.

(Article by Baxter, page 67)

PLATE II

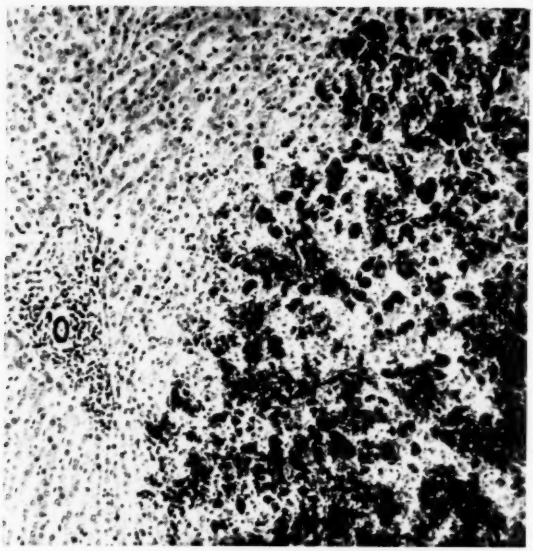

FIG. 2 Liver. Junction of a melanoma and hepatic tissue. H. and E. x 100

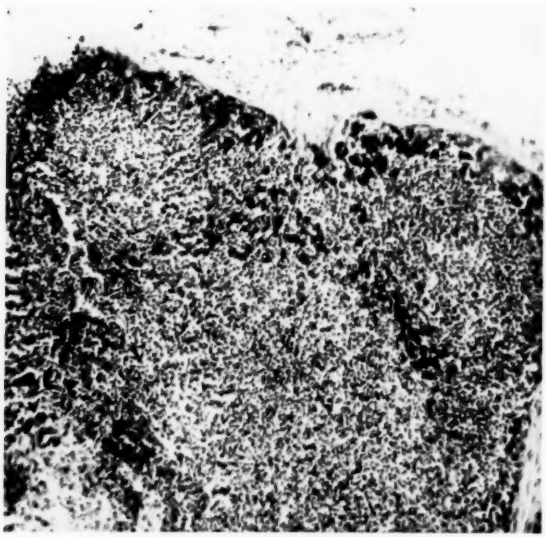

FIG 3 Hepatic lymphnodes involved in the neoplastic process. H. and E. x 100.

(Article by Baxter, page 67)

OBSERVATIONS ON CALF DISEASES IN KENYA

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PART II—CALF SCOURS: COLI-BACILLOSIS OF CALVES, WITH SPECIAL REFERENCE TO VACCINATION

In Part I of this paper it was stated that calf scours due to *E. coli* causes considerable losses of calves in Kenya both on farms where calf management is excellent and on farms where calves are reared in an unsuitable environment.

Calves in Kenya are reared in the open air and with such advantages it might be surmised that the calf in Kenya would escape the hazard of coli-bacillosis. When this disease makes its appearance in such a calf community, it spreads rapidly and flies are probably a means of spread ; the handling of calves by native labour is also suspect. Moreover, the calving season in Kenya often coincides with the first flush of pasture grasses shortly after the onset of the long rains (mid-April to mid-July). Consequently, down-calvers may have been short of pasture during the last few months of gestation. Calves often lack vigour and stamina and this may be related to reduced vitamin A which is provided in the colostrum of the dam "steamed up" under English conditions. The weakly calf in Kenya is, therefore, prone to coli-bacillosis. On farms where the nutrition of the cow is adequately maintained during the gestation period, this disease is rarely encountered. The greatest protection against it would, therefore, seem to be the production of healthy calves born from dams in a high state of nutrition and, thereafter, properly managed, preferably by the farmer's wife. In the few farms where outbreaks have occurred despite every care, the possible explanation is that peculiarly virulent strains of the infective organism invaded the community, by additions to the herd. It has, however, not been established that cows harbour potentially dangerous strains of *E. coli*.

On 28 farms in Kenya on which the problem of coli-bacillosis of calves was investigated, the incidence of the disease was severe and the annual mortality was between 20 and 30 per cent of all calves born. These farms were selected for the survey because of the known high mortality in calves and the figure is probably an exaggeration of the true incidence of the disease on farms throughout Kenya.

In England, the disease is one of calves of a few days old. In Kenya, the disease has been observed both in calves of this age group and, commonly in a subacute form, in calves up to one month and older. Such cases are often diagnosed at autopsy only when the causal organism is isolated from the gall bladder, the bone marrow and the mesenteric lymph glands. The majority of these cases occur on "white scour farms," where the disease appears regularly every calving season. Treatment of calves a few days old and at the onset of symptoms, is often only partially successful and several relapses may occur before death from pneumonia at about four months of age. As will be shown later, the strains of *E. coli* isolated from such cases are resistant to the drugs that have been used in

treatment. An outbreak can usually be controlled in fresh centres of infection, if the earliest cases are treated promptly and adequately with a drug to which the causal strain(s) of *E. coli* are fully sensitive. If, however, the disease is allowed to build up in incidence through delay in treatment or through use of an ineffective drug, very few calves may survive. In Kenya, the farmer usually attempts to conduct his own diagnosis and treatment; the early cases of calf scours are often mild and not at once recognised and the disease may be firmly entrenched on the farm before treatment is begun. The farmer has access to a variety of drugs which would not be available to him in England and veterinary advice is only sought when the situation is out of control and the resident strains of *E. coli* have become resistant to the drugs already used.

Since 1927 various strains of *E. coli* isolated from cases of coli-bacillosis of calves in Kenya have been incorporated in a vaccine primarily intended for the control of calf paratyphoid due to *Salm. dublin*. Unsatisfactory control, however, led to the investigation, begun in 1952 and now recorded, into coli-bacillosis of calves.

The present paper is concerned with the study of strains of *E. coli* isolated from cases of coli-bacillosis on farms in Kenya, their comparative pathogenicity in laboratory mice, their sensitivity to sulphonamide and antibiotic drugs and the trial of vaccines prepared from indigenous strains of *E. coli* by two methods.

Materials and Methods

Calves affected with acute or subacute coli-bacillosis, varying in age from a few days to three months, were destroyed and cultures made in MacConkey broth from bone marrow, gall bladder and occasionally blood. The identity of 24 strains of *E. coli* isolated was established by the following biochemical tests: the production (or not) of acid and gas in dextrose, lactose, maltose, mannitol, dulcitol, adonitol, inositol, saccharose, dextrine, salicin; reaction in litmus milk; indole production; M.R.; V.P.; citrate utilisation; nitrate reduction and gas production in MacConkey broth at 44°C. A strain of *E. coli* from a case of coli-bacillosis of a calf in England was kindly supplied by Prof. Lovell; this strain was included in these tests for comparison with Kenya strains.

Twelve strains of *E. coli* isolated from different herds and the Lovell strain, were screened against sulphapyridine, sulphathiazole and sulphadimidine at two concentrations, viz, 1 and 5 mg.% by the technique of Harper and Cawston (1945). The sodium salts of these sulphonamides were used in the preparation of the media. The standard inoculum of each strain tested was 0.01 ml. 10^{-6} dilution of an 18 hour broth culture and plate counts showed that the inoculum contained approximately 60 viable organisms. The sulphonamide plates were incubated for 24 hours and the colonies counted; an estimate of the degree of inhibition was made. The same strains were screened against the soluble sodium salts of sulphapyridine and sulphathiazole in a separated milk medium known to contain no sulphonamide "antagonizers" (Edwards, 1949). Twofold dilutions of each sulphonamide were made in 5 ml. amounts of medium, in the range of 200—6.25 mg./ml. Each series of tubes was then inoculated with 0.1 ml. 10^{-6}

dilution of an 18-hour broth culture. Tubes were incubated for 24 hours and clotting of the medium was taken as evidence of no inhibition of growth. Cultures were made on agar plates from those taken with no apparent growth to determine whether the concentration of the sulphonamide had been bactericidal or bacteriostatic. The same strains were screened against dihydrostreptomycin sulphate, aureomycin hydrochloride and chloramphenicol in broth pH 7.4 at dilutions in the range 5, 10, 20, 50 and 100 μmg./ml. The inoculum used was 0.1 ml. 10^{-3} dilution of an 18 hour broth culture which contained about 40,000 viable organisms. A number of strains of *E. coli* other than the foregoing were screened against sulphathiazole sodium salt and Trinamide (May and Baker) in a broth medium described by Evans (1948) at dilutions in the range 200—6.25 mg.%. Trinamide is a compound of equal parts of sulphapyridine, sulphamerazine and sulphadiazine; for the purpose of this test this compound was prepared from the sodium soluble salts of each component. Three strains of *E. coli* tested have been isolated from calves on farms where the two sulphonamides had been used, with erratic results: three further strains were from farms where the disease had made a first appearance and treatment not yet instituted.

The pathogenicity of 6 of the 24 strains of *E. coli*, along with the Lovell strain, was examined in laboratory white mice. The Kenya strains were designated Knight, Eldoret, Randall, Allison, C.22 and M.2226. They produced capsules in broth culture, as did the Lovell strain.

(*a*) Two mice were each inoculated intra-peritoneally with 0.1 ml. of an 8 hour broth culture Knight strain and two mice with 0.01 ml. Four mice were each inoculated intravenously with a Seitz EK filtrate of a 48 hour broth culture of the same strain; two mice received 0.1 ml. and two 0.5 ml. filtrate.

(*b*) An 18 hour agar culture of Lovell strain was emulsified in normal saline the suspension adjusted at No. 8 opacity tube, and the following inoculations made in mice:

2 mice inoculated i.p. 0.1 ml. 10^{8} dilution.
" " " " " " 10^{6} "
" " " " " " 10^{4} "
" " " " " " 10^{2} "
" " " " " " undiluted suspension.

(*c*) With a similar suspension of Eldoret strain, two mice were inoculated i.p. with 0.1 ml. and two mice with 0.01 ml.

(*d*) Twenty-four hour broth cultures of Eldoret, Knight, Randall and Lovell strains were inoculated i.p. in mice at two dose rates, 0.01 ml. and 0.05 ml. Eight mice were used for each culture, four for each dose.

(*e*) Twenty-four hour blood agar cultures of strains C.22 and M.2226 were washed off with saline and the suspension adjusted at No. 8 opacity tube. Five mice were inoculated i.p. with 0.1 ml. and five mice with 0.01 ml. suspension.

(*f*) Six mice were inoculated i.p. with 18 hour broth culture Allison strain, three with 0.1 ml. and three with 0.01 ml. culture. Films were prepared from the

peritoneal exudate of all mice that died in these tests; they were stained by Giemsa and the degree of phagocytosis noted. Similar films were prepared from the liver and cultures in MacConkey broth were made from the heart blood of all of which died. The mice were observed for ten days after the inoculation.

The m.l.d. of the strains in mice, were thereby assessed and the *in vivo* protection of mice by aureomycin hydrochloride was examined. Five treated and five untreated mice were used for each of three strains. The antibiotic was given subcutaneously in a dose of 1 mg. in 0.5 ml. of water; all mice were then inoculated i.p. with 0.1 ml. 18 hour broth culture of the particular strain. Five mice were treated with antibiotic alone.

The antigenic structure of 11 strains of *E. coli*, and the Lovell strain, was examined according to their O group in the Kauffman scheme (1954).

The vitamin A liver reserve of 21 calves destroyed *in extremis* was estimated by the Carr-Price colorimetric method and the results recorded in terms of international units per gramme liver tissue. The calves varied in age between 5 days and 2 months of age. Three farms each provided three calves and the remainder came from farms where the disease had been present for some months.

An experimental vaccine was given to a few in-calf cows to determine whether it would protect the calves against coli-bacillosis and whether antibodies could be demonstrated in the colostrum. Four strains of *E. coli* were used in the vaccine; two (C.22 and C.23) were isolated from calves on the farm where the vaccine trial was undertaken and where losses among pure bred Guernsey calves had been serious for some months; the other two strains used in the vaccine were Lovell and Eldoret. Each strain was grown separately on nutrient agar in Roux flasks incubated for 24 hours at 37°C and the growth washed off with 0.1 per cent. formol/saline and standardised at No. 5 opacity tube. Equal parts of the four emulsions were pooled and the composite vaccine was incubated for two days. The usual sterility tests were made. A preliminary safety test was conducted and each of two yearling steers was vaccinated with 50 ml. and, seventeen days later, with 20 ml. vaccine. On the farm, five cows within one month of calving were vaccinated, three cows with 2 ml. and two with 50 ml. vaccine.

Sera from both steers were tested for agglutinins against H and O antigens of the four strains of *E. coli* used in the vaccine and against other Kenya strains (Knight, M.2231 and M.2226). Fifteen days after vaccination, a commercial *E. coli* antiserum was also tested against the same antigens

When the vaccinated cows calved, a sample of each colostrum was treated with rennet and the whey adjusted to pH 7.4. This was tested for agglutinins against H and O antigens of *E. coli* strains used in the vaccine, and strains of Kenya origin (Knight, M.2231, M.2226, M.2308 and M.2309).

Mouse protection tests were made against the four vaccine strains and using the whey obtained from the two cows vaccinated with 50 ml. vaccine, and the commercial antiserum and the serum from one of the vaccinated steers. Twenty mice were each inoculated subcutaneously with 0.2 ml. of the mixed wheys and

divided in batches of five which were then inoculated intraperitoneally, with 0.1 ml. of a saline suspension of an 18 hour blood agar culture adjusted at No. 8 opacity. One strain was used to each batch of mice. Equal numbers of mice were tested in a similar manner with the samples of serum. Three control mice were used for each strain. The degree of protection was assessed on survival and, in the event of death, by the interval between inoculation and death, and also by the degree of phagocytosis in Giemsa stained films of peritoneal exudate.

On another farm where coli-bacillosis of calves was rife, an alcoholised vaccine was prepared for vaccination of in-calf cows but the owner would permit its trial in one cow only. The strain of *E. coli* used was isolated from a fatal case of the disease on the farm, a calf six days old (Allison strain). A 24 hour broth culture was seeded on nutrient agar in Roux flasks which were incubated for 15 hours at 37°C. The growth was emulsified with a minimal amount of saline and a suspension of this made with 20 volumes of absolute alcohol. This was heated at 45°C for 30 minutes, centrifuged, and the deposit resuspended in 0.3 per cent. chlorocresol. The vaccine was standardised at No. 5 opacity tube and safety tests were made in rabbits. The cow was vaccinated with 40 ml. vaccine two months before calving and again, with the same dose, one month before calving. The colostral whey of the cow was used for agglutination tests against the O antigen of Allison strain. Two rabbits were each vaccinated with 0.5 ml. vaccine and revaccinated twice with the same dose at 10 day intervals. Ten days after each vaccination, the agglutination content of the serum was estimated.

Results

(1) Of the 24 strains of *E. coli* examined biochemically, all produced acid and gas in glucose, lactose, maltose, mannitol, dulcitol, acid clot in milk ; but inositol, adonitol and dextrine were not fermented ; all were M.R. positive and V.P. negative ; all were indole positive, reduced nitrate to nitrite, did not utilise citrate, and produced gas in MacConkey broth at 44°C. Nineteen strains produced acid and gas in saccharose ; two strains produced acid and gas in salicin but not in saccharose ; three strains produced acid and gas in saccharose and salicin and could be classified as *E. coli* var. *neapolitana*. All strains were motile and capsulated in varying degree ; ten were haemolytic on blood agar.

(2) Of the 12 strains screened against sulphapyridine by the technique of Harper and Cawston, three were fully sensitive to both concentrations ; two strains were fully sensitive to the higher and partially to the lower concentration ; seven strains were resistant at both concentrations. Two strains were fully sensitive to sulphathiazole at both concentrations and three were sensitive only at the higher concentration. The first two strains were those noted as being sensitive to sulphapyridine at the higher concentration ; the three strains sensitive to the higher concentration of sulphathiazole were those shown fully sensitive to sulphapyridine. Two strains were sensitive to sulphamezathine at the higher concentration ; of these, one was fully sensitive to sulphapyridine and partially to sulphathiazole,

and the other was fully sensitive to sulphamezathine and partially to sulphapyridine. Lovell strain was resistant to both sulphonamides.

The screening of the same strains against the same sulphonamides in milk medium gave similar results as given above. The three strains which were fully sensitive and the two partially so to sulphapyridine in the preceding test, did not produce clot in milk at dilutions within the range 200-6.25 mg.% but cultures were obtained on agar from all dilutions in which clotting of the medium did not occur; this showed that the reactions were bacteriostatic and not bactericidal. A similar reaction was seen in tubes of milk medium containing graded dilutions of sulphathiazole and inoculated with the 12 strains. The three strains fully sensitive to sulphathiazole and the two strains partially sensitive to this sulphonamide by the technique of Harper and Cawston did not produce clot in milk, but growth occurred on agar plates sown from tubes of all dilutions of the sulphonamide in which clotting was not observed. The two strains which were partially sensitive to sulphamezathine, behaved similarly in tubes of milk medium with graded dilutions of this sulphonamide screened against dilutions of chloramphenicol in broth tubes.

All strains were resistant to 5 μg./ml. One strain only was sensitive to 10 μg./ml. Three were resistant to 20 μg./ml. and all were sensitive to 50 μg./ml. All strains were resistant to 5 μg./ml. aureomycin, four were sensitive to 10 μg./ml., two were resistant to 20 μg./ml. and all were sensitive to 50 μg./ml.

Of the six strains screened against sulphathiazole in Evan's broth, two of the three strains isolated from outbreaks of the disease in which no sulphonamides had been used were sensitive in the range 200-12.5 mg.%: the third strain was sensitive in the range 200-50 mg.%. The three strains isolated from calves from different farms where coli-bacillosis had existed for some months and where the drug had been used, were all resistant to 200 mg.% sulphathiazole. Anomalous results were seen when these strains were tested against Trinamide. One strain only isolated from an outbreak in which no sulphonamides had been used was sensitive in the range 200-12.5 mg.%; the second strain was sensitive in the range 200-100 mg.% and the third in the range 200-50mg.%. The three strains isolated from calves on farms where sulphonamides had been used were resistant to the entire range of the compound sulphonamide.

(3) Pathogenicity Tests:

(*a*) One mouse inoculated with 0.1 ml. culture died in 20 hours. No illness was observed in the remaining mice, nor in the mice inoculated with filtrate.

(*b*) Two mice inoculated with undiluted suspension died, one at 24 and one at 36 hours.

(*c*) Two mice inoculated with 0.1 ml. Eldoret suspension died in 36 hours.

(*d*) No deaths occurred in mice inoculated with Knight and Lovell strains. One mouse inoculated with 0.05 ml. Randall strain died within six days. Three mice inoculated with 0.05 ml. Eldoret strain died; two after one day and one

after six days ; two mice inoculated with 0.01 ml. died, one after two and one after five days.

(*e*) Five mice inoculated with 0.1 ml. M.2226 strain died after 14-20 hours. One mouse inoculated with 0.01 ml. died in 20 hours and four of five mice inoculated with 0.1 ml. C.22 strain died within 14-20 hours ; one mouse inoculated with 0.01 ml. died within the same period

(*f*) Two of three mice inoculated with 0.1 ml. Allison strain died in 16 hours.

E. coli was isolated from the heart blood of all dead mice and films of the peritoneal exudate showed numerous, often swarming organisms of *E. coli* few neutrophils and many phagocytes of endothelial origin. Phagocytosis of organisms by these cells was negligible ; the strongly capsulated organisms appeared to exert an anti-phagocytic reaction. However, the examination of films from the peritoneal surface of mice inoculated with strain M.2226 and strain C.22, which proved more lethal to mice than the other strains, showed little encapsulation of organisms and there was considerable phagocytosis. The liver and kidney of all mice that died showed a cloudy swelling. Films prepared from the livers showed *E. coli* in variable numbers ; these organisms were devoid of capsules although in some cases encapsulated forms alone were present in the peritoneal exudate.

(4) Of five mice treated with aureomycin and then infected with Allison strain, two died after 48 hours and three after 72 hours. Five controls died in 14-20 hours. Five mice inoculated with strain M.2226, and then treated with the antibiotic, died after 20-24 hours as did the five controls. With Knight strain, the deaths in treated mice were, one at 24, one at 48 and one at 72 hours. Two control mice died after 24 hours. No deaths other than those recorded occurred within ten days. No reaction occurred in the five mice treated with aureomycin alone.

(5) Two of the three strains of *E. coli* isolated from calves on the same farm were typed as O group-11 and O group-24 respectively ; the third strain did not belong to any of the known *E. coli* groups 1-128. Two strains isolated from calves on a second farm were O group-36 and O group-7 respectively. Two strains isolated from calves on a third farm were O group-24 and O group-11. Lovell strain belonged to 0-86 and one Kenya strain only (Eldoret) belonged to this group. Of the other strains typed, two were in O group-8 and one in O group-24 ; one strain could not be typed.

(6) The vitamin A assay of the livers of 21 calves gave the following results: 0-10 I.U./g.—two calves ; 10.20 I.U./g.—four calves ; 20-30 I.U./g.—two calves ; 30-40 I.U./g.—four calves ; 40-50 I.U./g.—one calf ; 50-60 I.U./g.—one calf ; 60-70 I.U./g.—one calf ; 70-80 I.U./g.—three calves ; 80-90 I.U./g.—nil ; 90-100 I.U./g.—two calves ; 100-110 I.U./g.—one calf. There was no correlation between the age of the calf and the liver vitamin A reserve. The highest level was seen in a week old calf and the lowest in two calves six and eight weeks old from two different farms. On one farm, three calves in the age group 7-16 days gave the readings 42.5, 55, and 79 I.U./g. On a second farm, the readings for three calves

TABLE I

Agglutination tests against suspensions of *E. coli*

E. Coli Strains	*Knight*		*Lovell*		M.2231		M.2226		C.22		C.23		*Eldoret*		M.2308		M.2309	
Antigens	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*	*O*	*H*
SERA																		
Commercial	400	5000	—	—	—	30	—	250	—	—	—	—	—	—	—	—	—	—
Steer 1 1st vaccination	125	250	—	—	—	30	—	—	0	250	0	30	—	—	—	—	—	—
Steer 2 1st vaccination	—	—	—	—	—	—	—	—	—	40	—	40	—	—	—	—	—	—
Steer 1 2nd vaccination	250	2500	60	—	—	60	125	60	—	250	—	40	—	250	—	—	—	—
Steer 2 2nd vaccination	40	250	40	—	—	40	40	60	—	60	—	—	—	250	—	—	—	—
WHEY																		
Cow 1	—	—	60	—	—	—	—	—	—	—	—	—	—	60	—	—	—	—
Cow 2	—	—	—	—	—	—	—	—	—	—	—	—	—	60	—	—	—	—
Cow 3	—	—	—	—	—	—	—	—	—	—	—	60	—	—	—	—	—	—
Cow 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cow 5	—	—	—	—	—	—	—	—	—	—	—	40	—	—	—	—	—	—

Notes: Agglutination titres are expressed as reciprocals.
Cows 1 and 2 were each vaccinated with 50 ml. vaccine.
Cows 3, 4 and 5 were vaccinated once with 2.0 ml. vaccine.

6-10 days old were 34,61 and 106 I.U./g. On a third farm, the readings for three calves in the same age group were 20, 32 and 95 I.U./g.

(7, 8 & 9) Table I gives the results of agglutination tests with sera from five cows and two steers vaccinated with formalinised vaccine, and with the colostral whey from these cows after calving, against H and O antigens of the vaccine strains and other strains of Kenya origin. The commercial *E. coli* antiserum was included in the tests.

(10) Table II gives the results of the attempted mouse protection tests. In most mice that succumbed after the inoculation of whey or serum and the bacterial suspensions, films of the peritoneal exudate stained by Giemsa presented the same picture as in films from the control mice. A few exceptions seemed worth noting; the peritoneal films of mice inoculated with whey and Knight suspension showed moderate phagocytosis and about 80 per cent. of organisms were encap-

TABLE II

Mouse protection tests

Number of Mice Inoculated	*Nature of Inoculation and Route of Inoculation*	*How Infected*	*Deaths: Hours after Inoculation*
5	0.2 ml. whey s/c	0.1 ml. Lovell suspension i/p	2-24:1-48
3	Control mice	0.1 ml. Lovell suspension i/p	2-24
5	0.2 ml. whey s/c	0.1 ml. Knight suspension i/p	2-24:1-48
3	Control mice	0.1 ml. Knight suspension i/p	2-24
5	0.2 ml. whey s/c	0.1 ml. Eldoret suspension i/p	3-24
3	Control mice	0.1 ml. Eldoret suspension i/p	1-24:1-48
5	0.2 ml. whey s/c	0.1 ml. C.22 suspension i/p	2-24
3	Control mice	0.1 ml. C.22 suspension i/p	2-24
5	0.2 ml. serum Steer 2 s/c	0.1 ml. Lovell suspension i/p	1-72
3	Control mice	0.1 ml. Lovell suspension i/p	1-48
5	0.2 ml. serum Steer 2 s/c	0.1 ml. Knight suspension i/p	1-24:2-48
3	Control mice	0.1 ml. Knight suspension i/p	2-24
5	0.2 ml. serum Steer 2 s/c	0.1 ml. Eldoret suspension i/p	2-24
3	Control mice	0.1 ml. Eldoret suspension i/p	2-24
5	0.2 ml. serum Steer 2 s/c	0.1 ml. C.22 suspension i/p	1-24:2-48
3	Control mice	0.1 ml. C.22 suspension i/p	2-24:1-48
5	0.2 ml. B.W. antiserum s/c	0.1 ml. Lovell suspension i/p	1-24:1-48
3	Control mice	0.1 ml. Lovell suspension i/p	1-24:1-48
5	0.2 ml. B.W. antiserum s/c	0.1 ml. Knight suspension i/p	2-24:1-48
3	Control mice	0.1 ml. Knight suspension i/p	2-24
5	0.2 ml. B.W. antiserum s/c	0.1 ml. Eldoret suspension i/p	3-24:1-48
3	Control mice	0.1 ml. Eldoret suspension i/p	2-24:1-48
5	0.2 ml. B.W. antiserum s/c	0.1 ml. C.22 suspension i/p	2-24
3	Control mice	0.1 ml. C.22 suspension i/p	2-24:1-48

sulated; organisms within phagocytes retained the capsule. A similar effect was noted in peritoneal films of mice inoculated with steer serum and Eldoret suspension. The films from mice inoculated with commercial serum followed by Knight

suspension, showed about 20 per cent encapsulated organisms and both these and non-encapsulated forms appeared to be undergoing bacteriolysis: phagocytes, both neutrophils and endothelial cells, were abundant but contained no organisms. The same picture was exhibited, with slight variation, in mice given commercial antiserum and then inoculated with C.22, Lovell or Eldoret suspension. Very few, or no, organisms were seen in peritoneal films of mice given this serum followed by C.22 suspension.

(11) Of the two rabbits vaccinated with Allison vaccine one had a serum titre 1/40 against homologous O antigen ten days after the first vaccination: the serum of the second rabbit did not agglutinate to the suspension. Ten days after the second vaccination the titres were 1/60 and 1/40, and after the third vaccination the titre of both sera was 1/600. The colostral whey of the cow vaccinated twice with Allison vaccine did not react with Allison O antigen. The calf of this cow succumbed to an acute attack of coli-bacillosis when eight days old.

Discussion

In a review of the epidemiology of white scours of calves, Lovell (1955) stated that, during the course of an outbreak in an enclosed community, one serological type of *E. coli* may predominate during the early stages of the outbreak and be followed by other serotypes introduced by the admission of calves to the community from outside sources; this increase in different types of the organism then results in an increase in their individual virulence and the severity of the outbreak. This diversity of serological types of *E. coli* during an outbreak of coli-bacillosis was seen in three enclosed calf communities on farms in Kenya to which no calves had been introduced from other farms during the course of the outbreak. The term "outbreak" scarcely applies to the occurrence of the disease on Kenya farms on which the disease smoulders for months or years. Cases may be seen in calves up to three months old, some of which recover with or without treatment; many may remain carriers of one or more serotypes of *E. coli*. Strains of *E. coli*, which have not been serologically typed, have frequently been isolated immediately after slaughter from the gall bladder of cows from farms where the disease has been endemic for years. It is not improbable that these strains were acquired as the result of a calfhood infection. That the cows of a herd may harbour pathogenic strains of *E. coli* which may be disseminated amongst calves is nowhere stated in the literature, but the observation noted now would seem to merit attention. Of the 11 strains of *E. coli* of Kenya origin which were typed serologically, five distinct serotypes were presented by eight strains, and three strains belonged to no known type. Untyped strains of *E. coli* can cause outbreaks of calf scours in Kenya, just as Lovell has shown in Great Britain.

The main purpose of the investigation now recorded has been to determine whether a formalinised vaccine prepared from several serotypes of *E. coli* of calf scours origin could be of prophylactic value. The attempt failed. Immune substances did not develop within the colostrum of cows vaccinated in the terminal stages of gestation against the types of *E. coli* used in the vaccine. Batches of mice were not protected when they were inoculated with a moderate dose of the several types along with what was considered an adequate dose of the whey from vaccinated cows. Nor did such wheys show any agglutinins against H and O

antigens prepared from the vaccine strains. The sera of two steers given large doses of the vaccine likewise failed in mouse protection tests though they agglutinated H and O antigens of several of the component strains of vaccine.

The development of colostral immunity alone matters in vaccination against *E. coli* in the attempted control of white scours of calves. On the evidence now available, no prospect of success is offered by the vaccination of cows in gestation with large doses of a formalinised vaccine prepared from strains of *E. coli* isolated from calves during the course of an outbreak. Only one cow was vaccinated with an alcoholised vaccine prepared from a strain of *E. coli* isolated ... an outbreak of disease on the farm; the colostral whey showed no ...atinins against O antigen of this strain. The calf died from calf scours at ... age of eight days.

If it can be accepted that the results of the agglutination test are of any significance as portending an immunity response, the use of an *E. coli* antiserum in the field control of white scours is of doubtful value. The commercial antiserum showed reasonable agglutination titres against H and O antigens of only one of nine strains tested. The sera of two steers given formalinised vaccine in high dosage agglutinated the O antigen of three strains. However, none of these sera proved of any value in mouse protection tests. Obviously, a serum of value would have to be prepared from as many serological types of *E. coli* as exist in Kenya and such a polyvalent serum would be weak in protection against any one serotype.

The problem of vaccination against white scours of calves is perhaps not insoluble. At the moment, therapeutic control is mainly relied upon in Kenya. The results of the sensitivity tests of 12 strains of *E. coli* isolated from fatal cases of the disease in Kenya show that strains resistant to the range of sulphonamides and antibiotics are frequently encountered, and, in fact, the reliance on drug therapy is overestimated.

The relationship between low levels of vitamin A in the colostrum of the dam and the high incidence of white scours in the calves born of such dams has been commented on by many workers (Stewart and McCallum; Barron; Lundquist and Philips; Moore and Berry). The concept of the protective value of vitamin A in the colostrum has been tempered by the new knowledge that the protective value of the colostrum is due to the presence of specific antibodies against serotypes of *E. coli*, which can be demonstrated by agglutination and mouse protection tests. However, the thesis of the protective value of an adequate intake of vitamin A is so well documented that it cannot be entirely ignored. Calves born of cows which have been under the stress of prolonged vitamin A deficiency during semi-drought conditions in Kenya are weakly and notoriously liable to be victims of white scours. The vitamin A liver reserve of calves affected with the disease was examined during the investigation and found to be dangerously low.

Summary

1. Twenty-four strains of *E. coli* were isolated from fatal cases of calf scours on farms in Kenya. These were examined biochemically. Nineteen strains

fermented saccharose and two fermented salicin; three fermented both carbohydrates.

2. Twelve of these strains, including one of English origin, were screened against a range of sulphonamides and antibiotics and the majority of strains showed some resistance.

3. The virulence of six strains for mice was examined.

4. Eleven strains were typed serologically according to their O group in the Kauffmann scheme.

5. The vitamin A level reserve of 21 calves affected with calf scours and destroyed *in extremis* was examined by the Carr-Price method.

6. Cows were vaccinated with a formalinised vaccine during late gestation. The vaccine was prepared from three Kenya strains and one English strain. When the cows calved the colostral whey was used in mouse protection tests against the component strains and also in agglutination tests against H and O antigens of these and six other Kenya strains. The results showed that the whey of vaccinated cows possessed no antibodies against the vaccine strains.

7. Two steers were vaccinated twice with large doses of the same vaccine. Fifteen days after the second vaccination the sera of both steers as well as a commercial *E. coli* antiserum were tested for agglutinins against the same H and O antigens; significant titres were exhibited against one strain only.

8. Neither the commercial serum nor the serum of one of the vaccinated steers protected mice against the vaccine strains.

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CHICK MORTALITY AND THE CONTAMINATION OF YOLKS BY MEMBERS OF THE ENTEROBACTERIACEAE

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The enteric bacteria are a common cause of heavy chick losses. Pullorum disease is a serious problem where the poultry industry is well developed. The importance of this malady also lies in the fact that it is an egg-borne infection and apart from high chick-mortality, an infected hen may lay infective eggs which will hatch into infected chicks, and in turn become adult infected hens. Thus the cycle is repeated if the infected carriers are not detected and removed. Kaupp (1933) reported heavy losses among chicks due to pullorum disease, and others including Biester and Schwarte (1957) have recorded their observations; the total mortalities might approximate to 85% or over, during the first four weeks of life.

Those engaged with the *post-mortem* examination of poultry, know that baby chicks often reveal the presence of unabsorbed and dried out yolk sacs. Inflammation of the navel in baby chicks is, however, not uncommon. Volkmar (1928) concluded that after the chicks hatch, the navel fails to close properly following the drawing of the yolk sac into the abdominal cavity, and infection may occur.

Watts and Rac (1958) have discussed the common causes of mortality in chicks of up to ten days of age and they have shown that omphalitis and unabsorbed yolk sac are common causes. Harry (1957) carried out investigation on the aetiology of yolk sac infection and isolated bacteria from the yolk of infected chicks.

In this preliminary work attempts were made to isolate salmonella from chicks which died at the Poultry Farm attached to the U.P. College of Veterinary Science and Animal Husbandry, Mathura, U.P., India and revealed the presence of unabsorbed yolk sac. A simultaneous attempt was also made to isolate and identify other members of the Enterobacteriaceae from the carcases of chicks showing no gross *post-mortem* changes.

Materials and Methods

Bacteriological examination was made, on 146 carcases of White Leghorn chicks submitted for routine *post-mortem* examination to the department of Pathology and Bacteriology, U.P. College of Veterinary Science, Mathura. The method used for the isolation of Salmonellae was on the lines advocated by Edwards *et al.* (1948) for the detection of Salmonella infection of fowls.

A bacteriological examination was also made on 100 carcases of chicks with unabsorbed yolk sac showing no gross *post-mortem* change. Attention was paid to the

other members of the Enterobacteriaceae family. Cultures were made from the unabsorbed yolk direct on to plates of MacConkey's medium and into nutrient broth. If there was no growth on the plates after 24 hours incubation, the broth cultures were streaked on MacConkey's plates and incubated at 37°C. for a further 24-48 hours. Well separated discrete colonies were selected for examination and identification.

Preliminary identification of the members of the family Enterobacteriaceae was based on their morphological, cultural and biochemical characters (see Kauffmann (1951) and Breed *et al.* (1957).) A few of the representative cultures were examined by the Dysentery Reference Laboratory, Colindale, London, for identification and confirmation.

Results

No Salmonellae were recovered from 146 specimens of chicks.

The Enterobacteriaceae isolated from the 100 specimens were *Escherichia, Aerobacter, Klebsiella,* and *Proteus*. The frequency with which they occurred is as follows:

Bacteria isolated from yolk	*Number of specimens from which isolated*
Escherichia coli	43
Klebsiella (species)	25
Aerobacter cloacae	6
Proteus (species)	3
Mixed infection	
E. coli + *Kleb.*	5
E. coli + *Aerobact.*	4
E. coli + *Proteus*	5
Kleb. + *Aerobact.*	1
Kleb. + *Proteus*	2
Aerobact. + *Proteus*	2
Number with negative findings	4
	100

Discussion

The position of Salmonella infection of chicks in India is somewhat different than it is in other countries. The wide spread infection of young chicks with *S. pullorum* is not recognised in India and it is apparently absent from most parts of he country (Iyer and Hashmi 1945). Slide agglutination tests with coloured Salmonella antigen and random samples of sera gave negative results and thereby indicated an apparent freedom of infection in adult birds according to Pathak (1959). Further, the results herewith recorded indicate an apparent freedom of the poultry from this infection although paratyphoid bacteria have been isolated from the adult breeding stock of this poultry farm (Pathak and Singh 1959).

The reports of Naidu (1938), Rao *et al.* (1952) and Rao (1955) show that infection is present in some parts of the country and there are recent indications of its presence

on some farms of West Bengal (Tulsa Ram 1958). Studies on the occurrence of salmonella in fowls must continue because poultry are imported into India from countries where this infection is not uncommon.

Haines (1938) records that the type of bacteria normally found in the alimentary tract and on the skin and feathers of the hen are present in large numbers on and in the shells of eggs. Harry (1957) confirmed these findings and suggested that these bacteria can cause the death of embryos and chicks. He has further shown that the bacteria originating from the alimentary tract of the hen and contaminating the shell can migrate to the yolk. Watts and Rac (1958) studied the causes of mortality in chicks up to ten days old and found that the greatest factor was omphalitis and unabsorbed yolk sac. The yolk flora reported in this study (vide supra) appear to be similar to those found in the alimentary tract of the fowl. *E. coli* is the most common, and this agrees with the findings of Harry (1957) who suggested that the principal source of these yolk contaminants is the alimentary tract of the chick and the bacteria migrate from there during the first few days after hatching.

During this investigation it was observed for about a week or so that the mortality in brooder chicks had been increasing. *Post-mortem* examination of the chicks showed the liver to be pale yellow in colour; the yolk sac was unabsorbed and in some cases the navel was inflamed. The yolk flora of the dead chicks contained large numbers of *E. coli* and *Klebsiella.* The mortality was checked within a few days of the cleaning of the brooders, the daily changing of the bedding material and the disinfecting of the surroundings with lime and heat by scorching. A thorough cleaning and disinfection of the equipment and surroundings and the frequent removal of excretal contamination appear to be important in preventing the death of chicks from a contamination of the yolk sac.

Summary

Salmonella were not isolated from the tissues of 146 specimens of chicks submitted for *post-mortem* examination.

From the study of the yolk flora of 100 dead chicks showing unabsorbed yolk sac, it was found that 43 were infected with *Escherichia,* 25 with *Klebsiella,* 6 with *Aerobacter,* 3 with *Proteus* and 19 with mixed infection while 4 gave no growth.

The importance of disinfection of eggs, incubators, brooders and other equipment concerned with chick raising is stressed.

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OBITUARY

DR- MED. BJORN SIGURDSSON

It is sad to learn that Bjorn Sigurdsson, the Director of the Institute for Experimental Pathology, Reykjavik, Iceland, died in October, 1959. He had been ill for some months.

Dr. Sigurdsson was born in March, 1913, and graduated in medicine from the University of Iceland Medical School in 1937. He worked in hospitals at Reykjavik for a year and then proceeded to Copenhagen, where he studied at the Biological Institute of the Carlsberg Foundation. He returned to the Department of Pathology of the University of Iceland in 1940. In 1941 he visited America, where for two years he had the stimulating experience of working at the Rockefeller Institute for Medical Research, Princeton, N.J.

He was thus well equipped to return to Iceland and become immersed in some of the problems which beset animals and man. After he had worked for two years at the Institute of Pathology he became director of the Institute for Experimental Pathology (University of Iceland) at Kaldur. This pleasant and delightful institute nestles in a valley about 8 kilometres from Reykjavik. Whilst at this institute he made a number of interesting, informative and valuable contributions to pathology and preventive medicine. From 1945 until his untimely death in 1959 Dr. Sigurdsson directed, stimulated and worked amongst a small band of enthusiasts.

He was honoured both at home and overseas. He was elected to the Chairmanship of the National Research Council of Iceland in 1954 ; he had been a member since 1943. He became a doctor of medicine of the University of Copenhagen in 1955 and was a member of the Societas scientiarum Islandica, the Society of Sigma Xi, Princeton, N.J., and of the Society for General Microbiology.

His reputation extended beyond the island where he worked so assiduously ; with his colleagues he contributed much to the understanding of " latent infections." The story of the disaster which may follow the introduction of apparently healthy animals into a fresh community is often told. Sheep conveyed to Iceland in 1933 appeared to be responsible for the introduction of maedi, jaagziekte and Johne's disease. The results were devastating and problems of pathological and of epidemiological interest abounded. In spite of the great and immediate economic urge, Dr. Sigurdsson and his colleagues paid attention to fundamental studies for therein might lie greater profit. An account of many of the studies and of those concerning another sheep disease, rida, was given in three special University of London lectures at the Royal Veterinary College, London, in March, 1954 (see this journal, vol. 110, pages 255, 307 and 341). He drew special attention to those infections which he called " slow virus infections." They have common fundamental characteristics ; they seem to be limited to one animal-host species and the lesions appear in a single organ or tissue system. The period of latency is long and may extend for months or years and the infections end in death. Jaagziekte, the Bittner mammary carcinoma of mice, lymphomatosis of the fowl, mouse leukaemia, and some other transmissible tumours may fit into this picture as well as maedi and rida.

In his short life, he had shown himself to be an investigator of a very high order. He was essentially the philosophic type of research worker and yet he did not neglect nor did he forget the practical aspects of his subject. He published original papers in American and in British journals, and in March, 1955, he contributed to the O.E.E.C. Conference on Johne's disease held at Weybridge.

It is not easy to pay adequate tribute to one who was already of established

renown and honoured in a field of investigation embracing diseases of man and animals. He could turn his hand to problems which were urgent and abstract from them truths of fundamental importance. He was a delightful companion and host, and his house was graced with a pleasant "homely" atmosphere. Iceland has lost a valuable citizen; the world of science has lost an outstanding worker, many have lost a dear friend.

NEWS

MINISTER OF AGRICULTURE, FISHERIES AND FOOD AT ANNUAL GENERAL MEETING OF LEICESTERSHIRE NATIONAL FARMERS' UNION

Addressing the Annual General Meeting of the Leicestershire National Farmers' Union at Leicester on 13th January, 1960, the Minister of Agriculture, Fisheries and Food, the Rt. Hon. John Hare, O.B.E., said:—

Animal Health

"In a few weeks time we shall declare the last eradication area in Great Britain for bovine tuberculosis. If all goes well, the whole of the country should be attested before the end of this year or at latest early next year. Many people have asked what the next steps are going to be in animal health when that job is done. This is a question to which we have been giving careful study. I cannot give you a final answer today, but there are one or two things I can say.

"The first point is that when the area eradication of bovine tuberculosis is done with, that does not mean that we can forget about the disease. In spite of the utmost vigilance odd cases will turn up here and there, and we shall need all our care to prevent infection building up afresh. We shall have to keep on with periodical testing for a long time ahead, although we shall be able gradually to reduce the frequency of tests, especially in the older attested areas. Nevertheless, the ending of area eradication will relieve the veterinary profession of much work.

"Where else can they concentrate their efforts? One of the matters which we have had under close review in this connection is pig diseases and especially swine fever. There is no easy answer and we shall need to consult a number of different authorities. But I shall make a statement as soon as I possibly can.

"We now have about 4,500 veterinary surgeons in this country compared with about 2,000 in the 'thirties. I would say that it is up to you farmers to see that the energies of this profession are fully used. There is tremendous scope for yet greater increases in agricultural productivity by using the help and advice of the private vet. This is especially true of the many things which call for individual treatment or preventive action on the spot.

Fowl Pest

"Obviously many of you are worried over the exceptionally heavy incidence of fowl pest since the beginning of last October. I certainly am; and the position is serious. During the first nine months of 1959, we had 540 outbreaks, and in the last three months, 1,522, making a total of 2,062 outbreaks for the year. Over

DR. MED. BJORN SIGURDSSON

4 million birds were slaughtered under the Diseases of Animals Act, and the amount of compensation was round about £3 million.

"But bad as this is, we should remember that over a very large part of the country there has been comparatively little fowl pest, and in a good many counties no outbreaks at all. In recent weeks, the trouble has tended very much to be localised in East Anglia, particularly in Norfolk, with sporadic outbreaks elsewhere. This is still so. There are signs of a diminishing intensity in both Norfolk and Suffolk, and it may be that at long last we are really getting on top of the disease, but I cannot say whether we are yet well and truly round the corner.

Pigs

"I am sure the best breakfast anyone could have is bacon and eggs with a glass of milk. If more people can be persuaded to share this line of thinking, many of our troubles would be over.

"Pigs have caught the headlines recently and scare talk has made some people worried about the future. I should like to say why I think there is no cause for this.

"There are two points I should particularly like to mention. First, the producers are looking for a stable price and the curers for a steady throughput. Now if you seriously want something of this kind you have to be prepared to pay something for it. The possibilities of voluntary long-term contracts between producers and the curers seem to me well worth exploring. The matter is one for the producers and the curers themselves. Each must be ready to give a little. But this would be a small premium to pay for the assurance that would result. It is not the Government's job to negotiate arrangements of this sort. But I am very ready to do everything I can to help if producers and curers show that they are really interested.

"Secondly, so long as we continue to produce good bacon, then there will always be a market here for British bacon. And, of course, our producers have the benefit of the guarantee.

"The present worries of the bacon pig producers are largely caused by the decline in the number of pigs. Two years ago we were faced with a subsidy Bill for pigs which was running at £40 million a year. Something obviously had to be done in the interests of the taxpayer, and the guaranteed price was reduced by 2/- a score. The breeding herd declined, but I think it has gone down more than it need have done. Our producers have the very real advantage of the guarantee, and I do not think there is cause for the lack of confidence which people have been talking about. Now if we don't produce the pigs which all sections of the trade need, we are not in a strong position to complain if our competitors take advantage of the situation. I should have thought, and I have said this elsewhere, that our undertaking that there would be no reduction in the standard price after the Review implied that the Government would like to see a moderate increase in the size of the breeding herd. Clearly, of course, we would not want to see an increase which would impose an unreasonable burden on the taxpayer. This is very much a matter of confidence.

Milk

"Our dairy farmers now supply our manufacturers with enough milk to provide most of the cream we eat, and almost all the condensed milk. About half our cheese is home-produced, but even in 1957, the year of abundance, we produced less than 10% of our butter. Most of the cheese that we import, and more than half the butter, comes from our Commonwealth friends. They have helped us

enormously during the recent period of high prices by limiting increases in price as far as possible, and thus keeping the market stable.

"Don't let us forget we have on our doorstep an enormous market for liquid milk. Through the industry's own efforts, that market has grown substantially in the past two years. Although we drink a lot of milk — just over two-thirds of a pint a day — we still do not drink as much milk as the Canadians, the New Zealanders, the Dutch or the Swiss. I believe the market is capable of further development. We should aim at leading the world in this.

British Agriculture

"Going round the country we see agriculture in all its diversity. There are enormous differences between farming in the hills of Wales, in the plains of East Anglia and in your own Midland counties. But one thing is clear for anyone with eyes to see. Well farmed land, well kept stock, good hedges and clean ditches, modern farm houses, cottages and buildings are there wherever you go. Throughout Britain the picture is one of prosperity, of progress and of real confidence."

MEAT FACTORIES OF THE FUTURE

There will be the customary Veterinary Hygiene Section at the 67th Annual Congress of the Royal Society of Health to be held at Torquay from 25th-29th April, 1960.

Lord Morrison of Lambeth will be this year's Congress President.

Details of the Veterinary Hygiene programme are as follows:—

FRIDAY, 29TH APRIL — SECTION L — VETERINARY HYGIENE

President: Sir Weldon Dalrymple-Champneys, Bt., C.B., M.A., D.M., F.R.C.P., D.P.H., F.R.S.H.

Recording Secretary : John C. Greatorex, Ph.D., M.R.C.V.S., F.R.S.H., Senior Lecturer, Royal Veterinary College, University of London.

1. Address by the President.
2. "Meat Factories of the Future: a look ahead" by Sir Frank Shires, Chairman, Board of Governors, National College of Food Technology.
3. "Pathological Abnormalities Encountered in Meat Inspection: a photographic record" by H. Thornton, B.V.Sc., M.R.C.V.S., D.V.H., F.R.S.H., Chief Veterinary Officer, Newcastle-upon-Tyne.